

**2006 Spring Simulation Interoperability Workshop
Invited Presentation Abstract – Space Track Forum**

Title: *Verification, Validation, and Accreditation Challenges of Distributed Simulation for Space Exploration Technology*, Danny Thomas, AEgis Technologies Group, Inc, Bobby Hartway, Teledyne Brown Engineering, and Joe Hale, Marshall Space Flight Center.

Abstract: Throughout its rich history, NASA has invested heavily in sophisticated simulation capabilities. These capabilities reside in NASA facilities across the country - and with partners around the world. NASA's Exploration Systems Mission Directorate (ESMD) has the opportunity to leverage these considerable investments to resolve technical questions relating to its missions. The distributed nature of the assets, both in terms of geography and organization, present challenges to their combined and coordinated use, but precedents of geographically distributed real-time simulations exist. This paper will show how technological advances in simulation can be employed to address the issues associated with netting NASA simulation assets.



Verification, Validation and Accreditation Challenges of Distributed Simulation for Space Exploration Technology

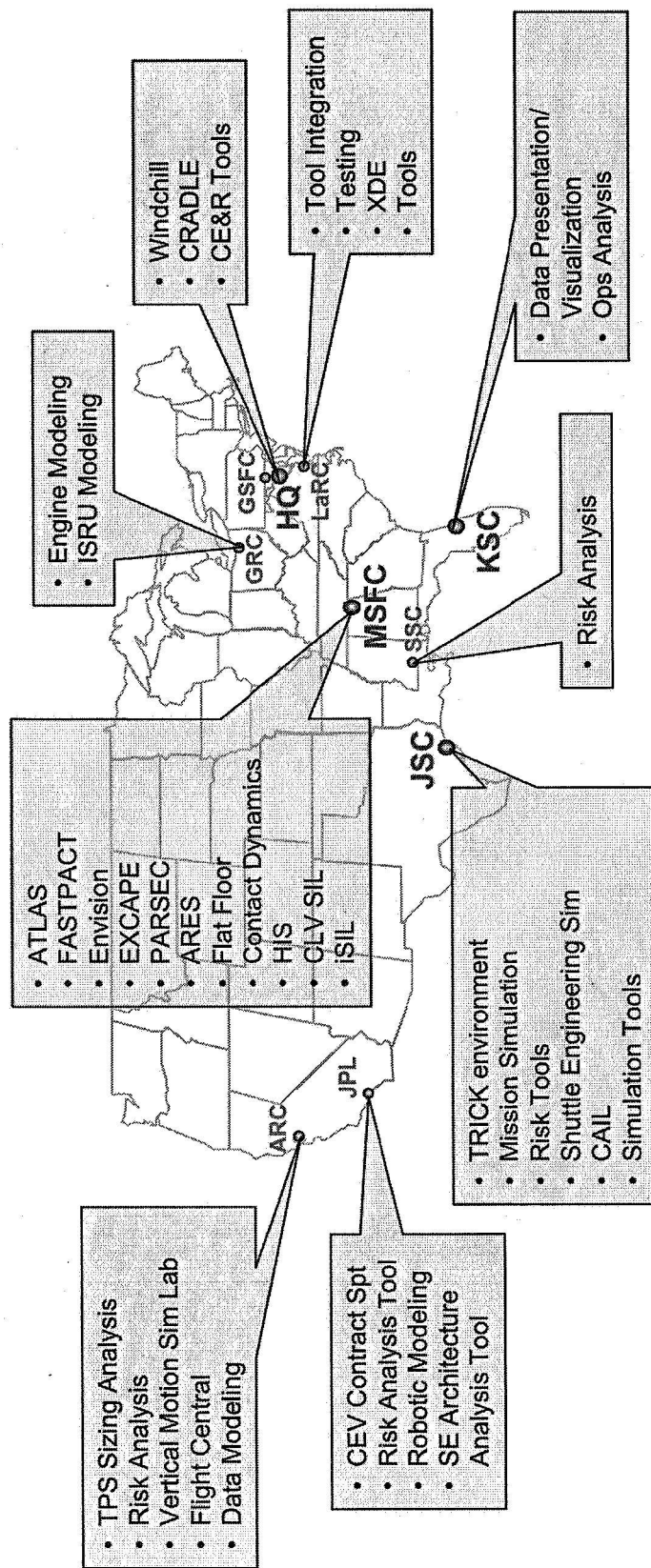
Advances in technology in distributed simulation present ESMD with the opportunity to use existing capabilities effectively, but some challenges exist in verifying and validating distributed systems for confident use.

Danny Thomas, Bobby Hartway, and Joe Hale
April 5, 2006



Collaborative Opportunities and Challenges

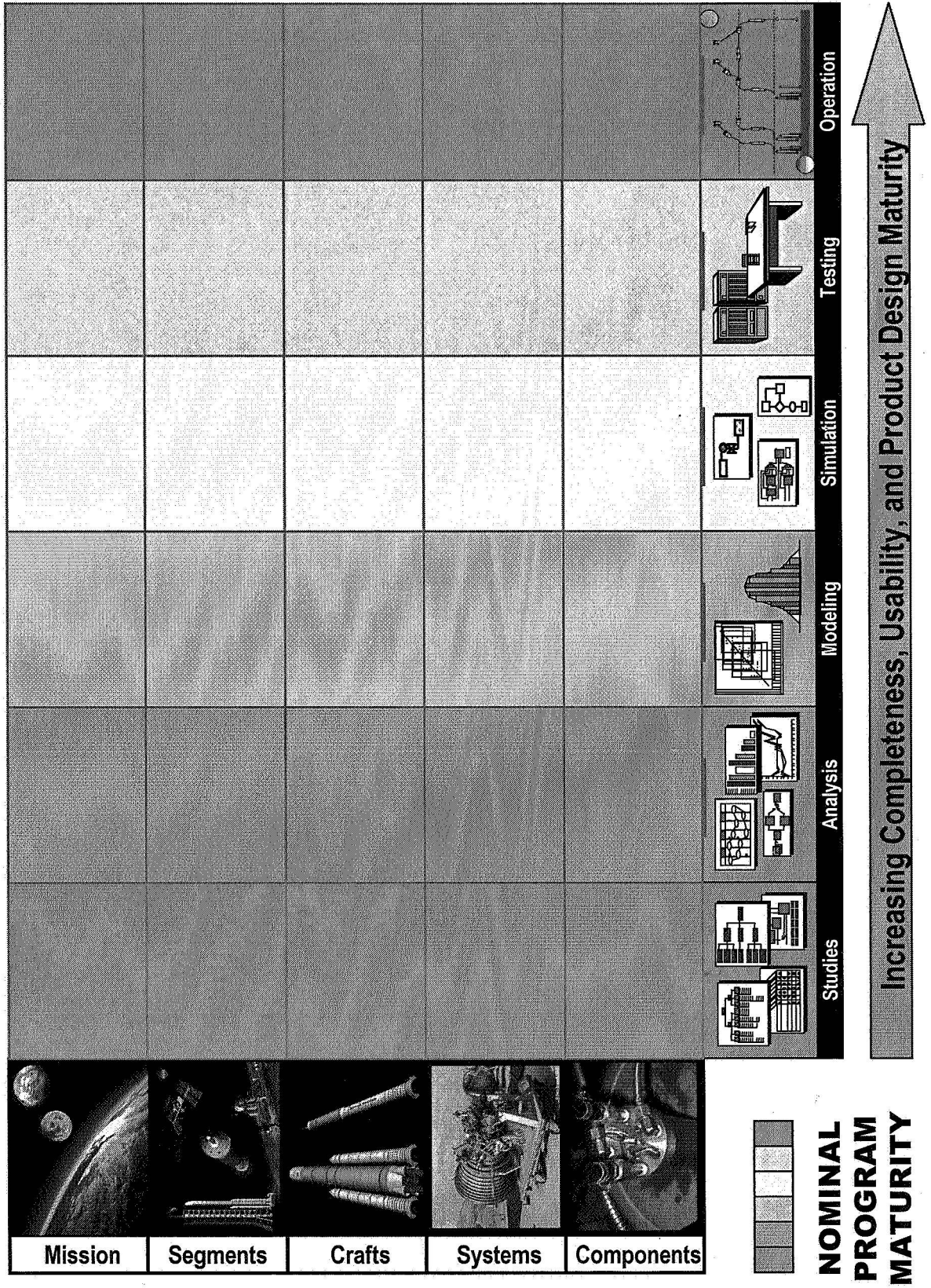
- Opportunities - Wide Spectrum of Capabilities Exist at Each Center
- Challenge - Need to Map Capabilities to Program Needs (Levels 1-3)

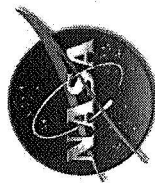


Establishing Collaborative Relationships is Critical for Integration



ESMD Simulation Space Evolves with the Program





Middleware for Distributed Simulation Technology is Constantly Evolving

Jini

Jini Is Not Initials

CCM Concavity Configuration Manager

TENA Test and Training Enabling Architecture

J2EE Java 2 Enterprise Edition

XML eXtensible Markup Language

HLA High Level Architecture

CORBA Common Object Request Broker Architecture

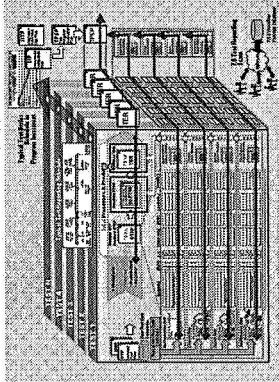
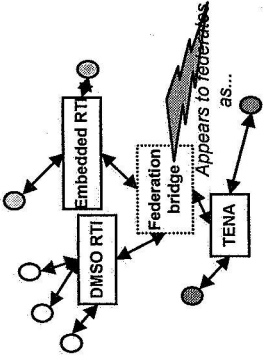

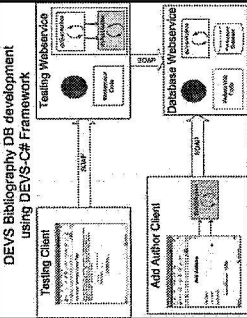
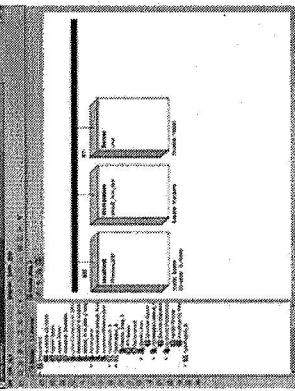
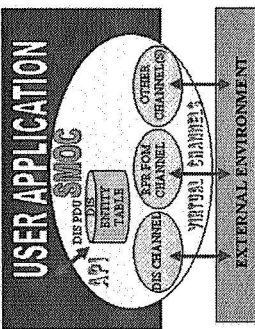
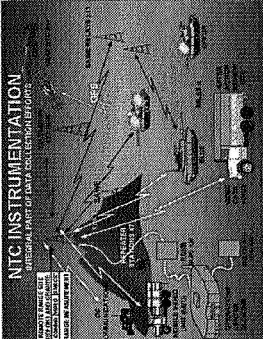
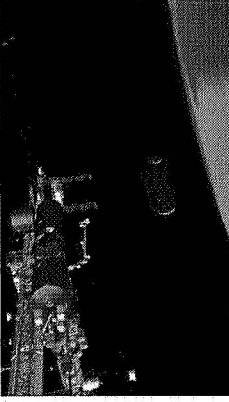
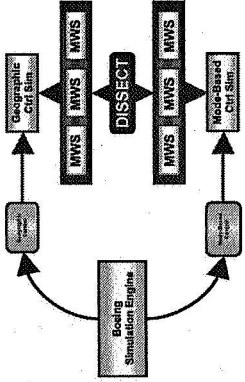
ALSP Aggregate Level Simulation Protocol

BIS Distributed Interactive Simulation

DCOM Distributed Component Object Model

TCP/IP Transmission Control Protocol /Internet Protocol

Middleware Timeline

 <p>TBE 1992 Distributed Modeling Simulation Environment (DMSE)</p>	 <p>Raytheon ACIMS 2001 Simulation Interoperability Toolkit (SIT)</p>	 <p>NLR 1999 National Aerospace Laboratory (GEAR)</p>
 <p>JITC ACIMS 2004 Discreet Event Specification (DEVS)</p>	 <p>Calytix 2005 (SIMPlicity)</p>	 <p>NAVAIR 2005 Simulation Middleware Object Classes (SMOC)</p>
 <p>Army 2005 Common Training Instrumentation Architecture (CTIA)</p>	 <p>NASA 2005 Trick Simulation Environment</p>	 <p>Vanderbilt DARPA 2005 (DISSECT)</p>

Pre-decisional DRAFT



Applicable Middleware Solutions Evolve as the Program and Simulations Mature

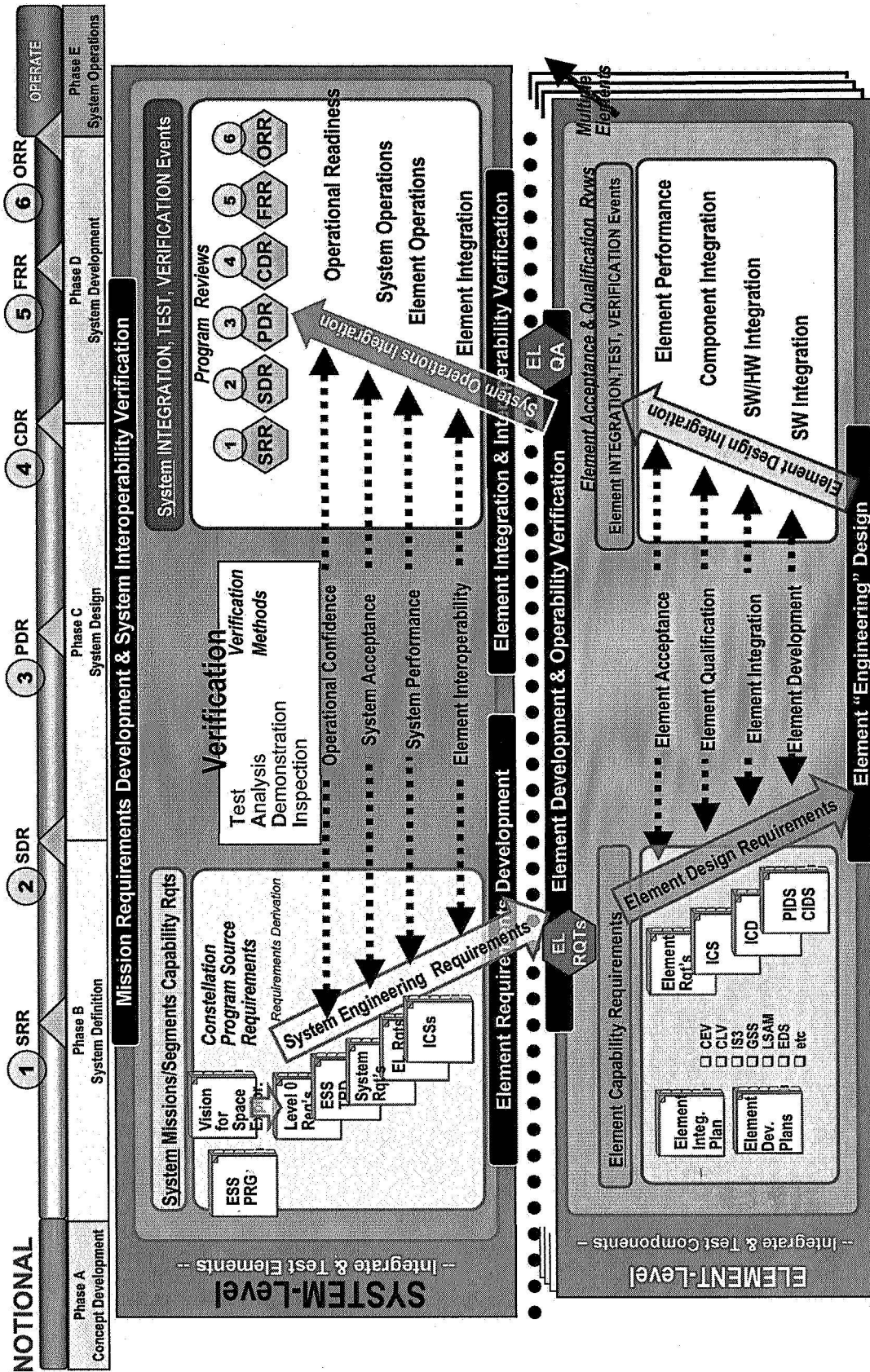
Mission	Segments	Crafts	Systems	Components
<div> <div></div> <div></div> <div></div> <div></div> <div></div> </div>				
NOMINAL PROGRAM MATURITY				
<div> <div>Studies</div> <div>Analysis</div> <div>Modeling</div> <div>Simulation</div> <div>Testing</div> <div>Operation</div> </div>				
Collaborative Distributed Databases Example Advanced Technology Lifecycle Analysis System (ATLAS)		DIS HLA Example Distributed Space Exploration Simulation (DSES)		TENA Operational Communication Example Integrated Systems Integration Laboratory (ISIL)

Increasing Completeness, Usability, and Product Design Maturity

Pre-decisional DRAFT



VW&A Supports an Integrated Modeling and Simulation Strategy

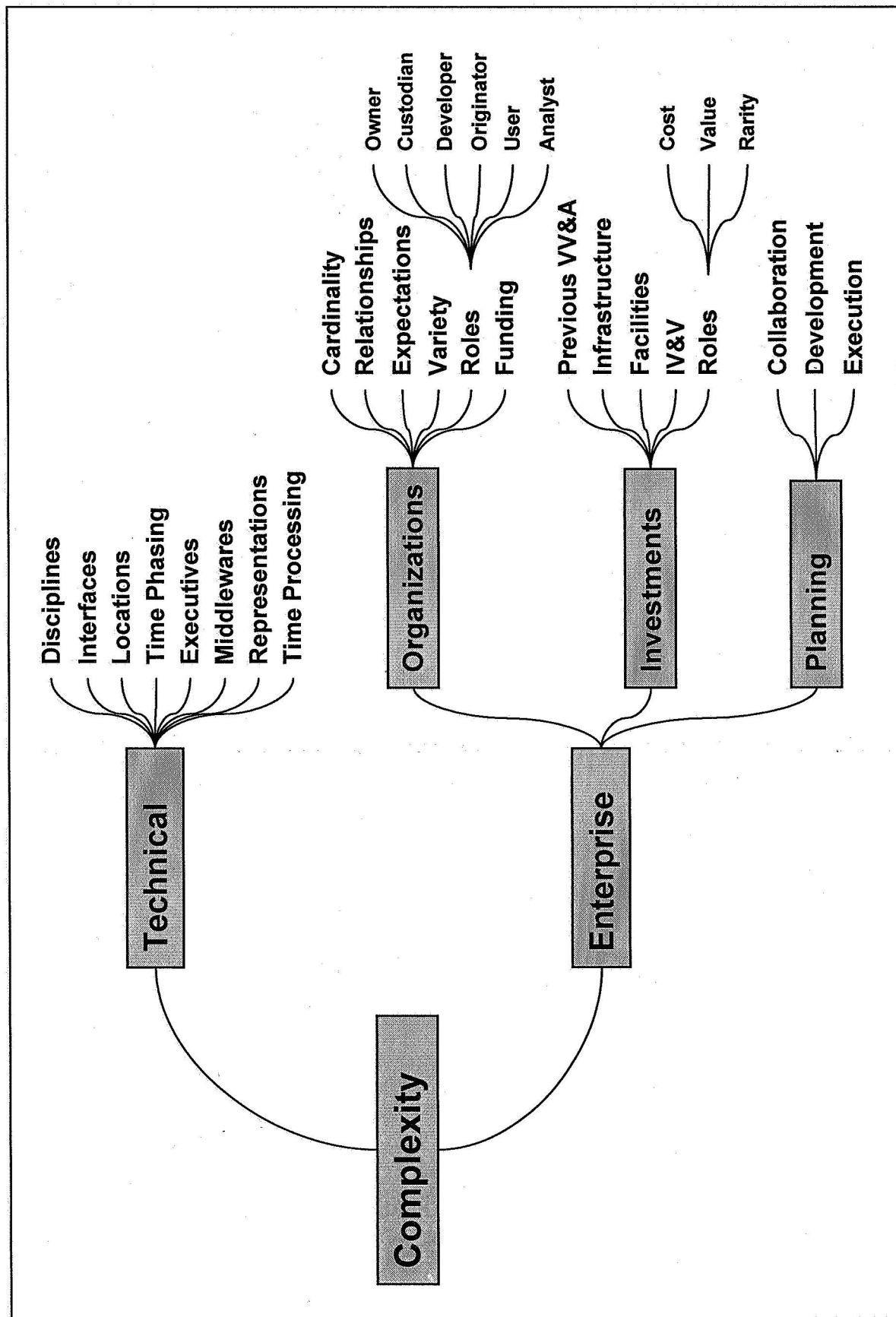


IM&S Supports Analytical & Acquisition Activities in System and Element Level SE

Pre-decisional DRAFT

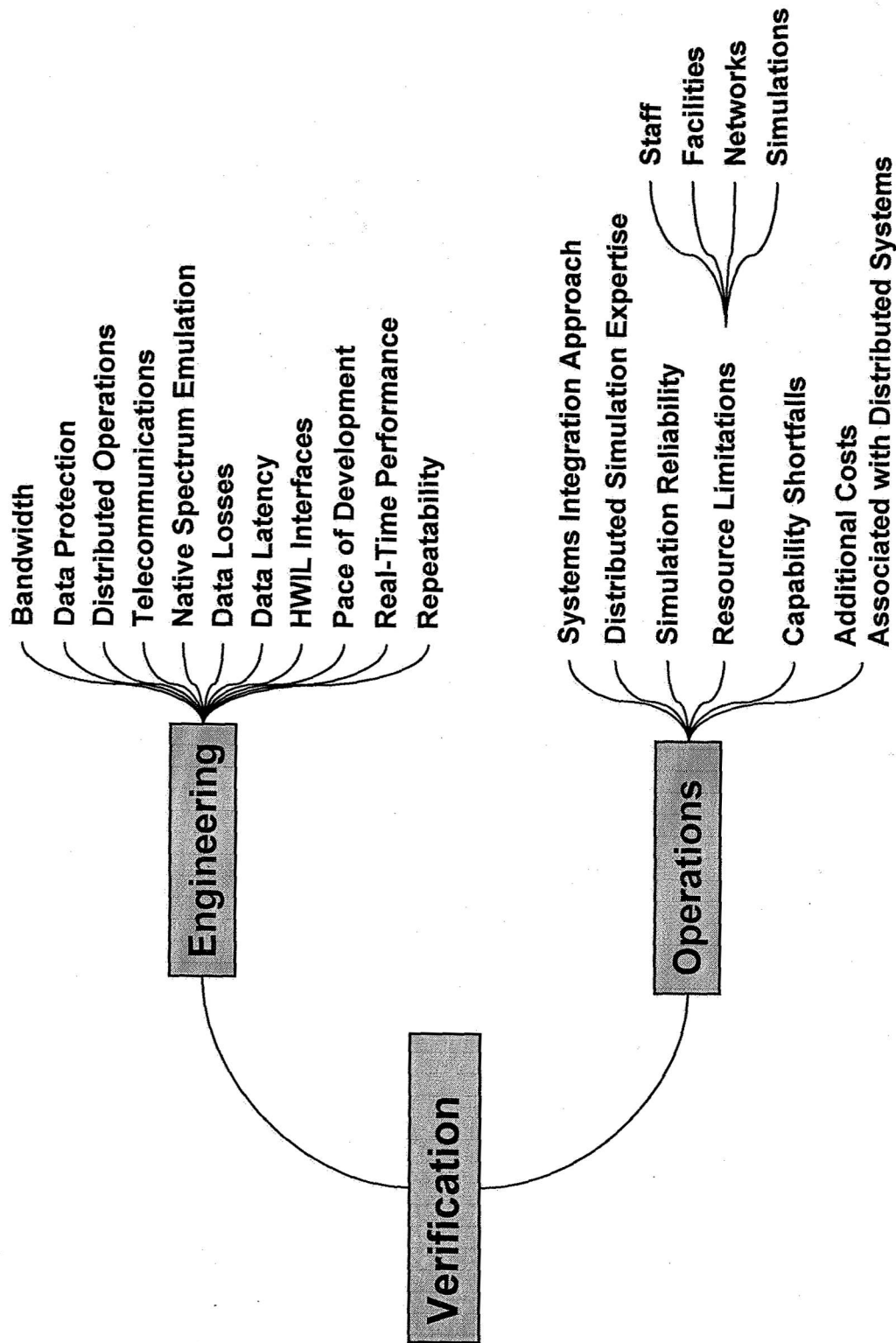


Complexity Challenges Facing VV&A of Distributed Simulation Systems



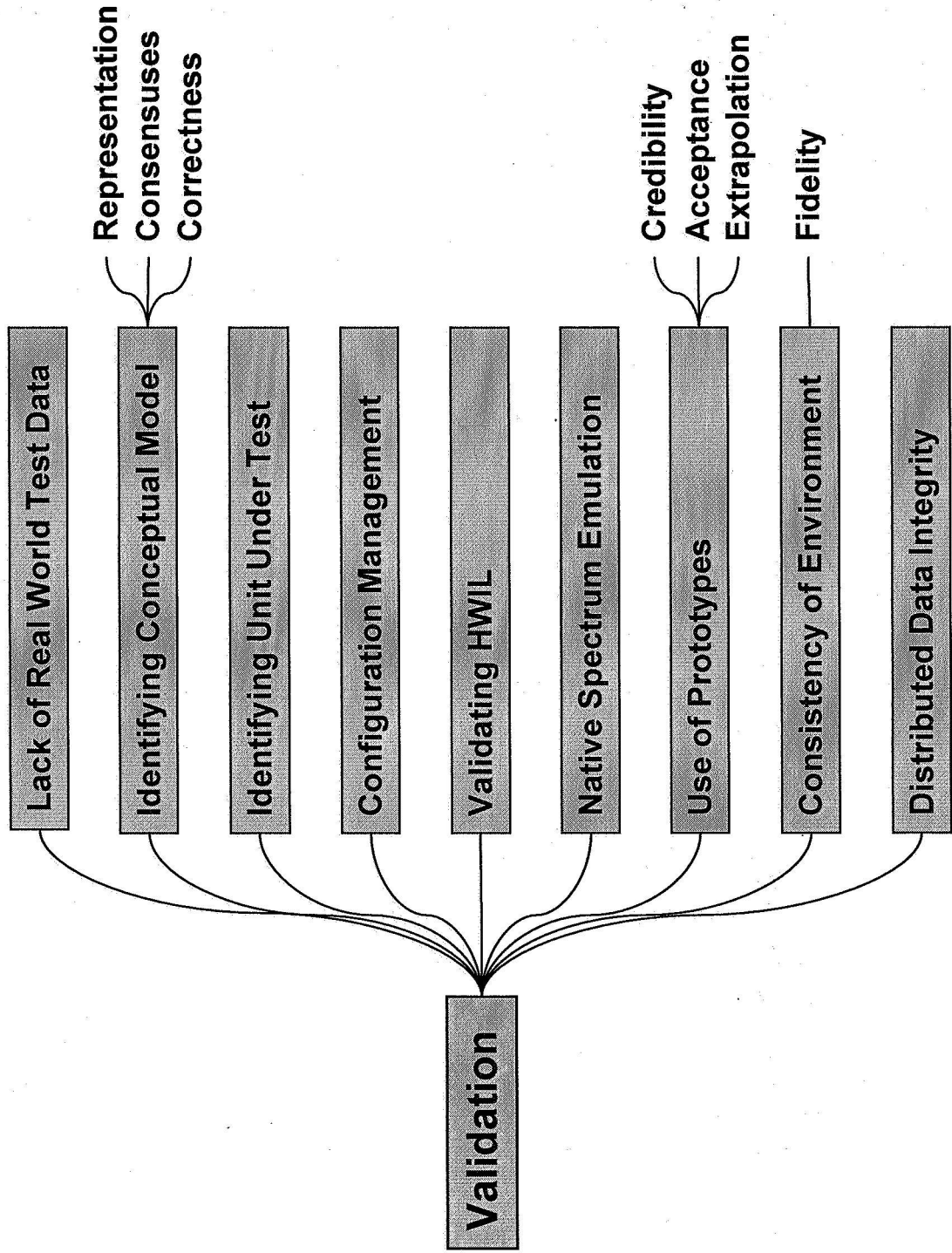


Verification Challenges Facing VW&A of Distributed Simulation Systems



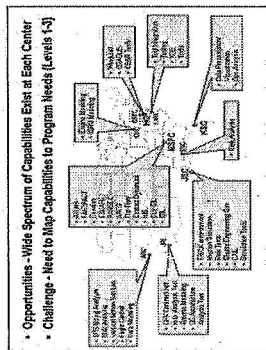


Validation Challenges Facing VW&A of Distributed Simulation Systems

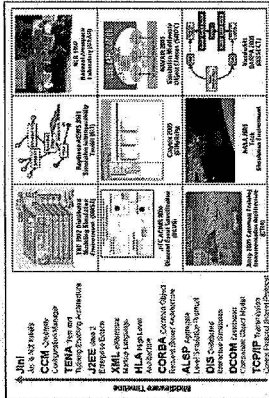




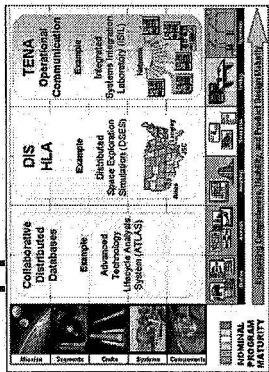
Assets



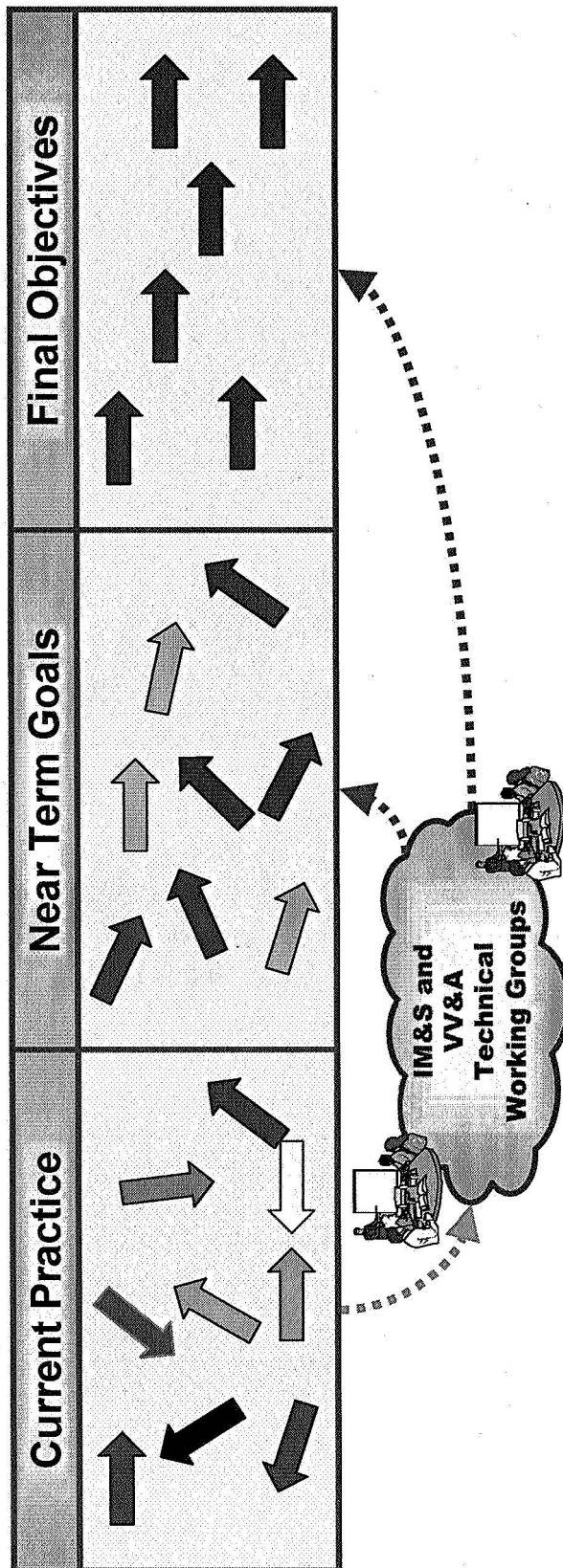
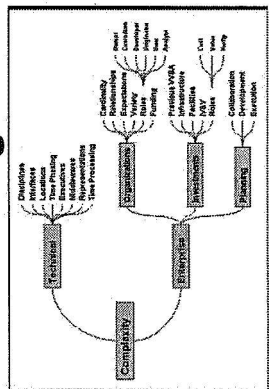
Advances



Opportunities



Challenges



NASA is developing an Integrated Modeling Simulation strategy including a VV&A approach to capitalize on the opportunities and meet the challenges.